IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Hongxin Song et al.		Art Unit : 2112	
Serial No. : 10/600,419		Examiner : Samir Wadie Rizk	
Filed : June 20, 2003		Conf. No. : 6709	

Title : AVERAGING SIGNALS TO IMPROVE SIGNAL INTERPRETATION

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
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BRIEF ON APPEAL

Sir:

This brief on appeal is being filed under 37 CFR 41.37 to perfect the notice of appeal, which was originally filed on July 30, 2008. The sections required by 37 CFR 41.37 follow.

(1) Real Party in Interest

This application is assigned of record to Marvell International Ltd. who is hence the real party in interest.

(2) Related Appeals and Interferences

There are no known related appeals or interferences.

(3) Status of Claims

Claims 1-6, 8-16, 18-26, 29-41, 43-48, 51-58, 60-68 and 71-78 are pending in the application, with claims 1, 9, 12, 19, 22, 30, 34, 43, 45, 52, 53, 61, 64 and 72 being independent. Claims 7, 17, 27, 42, 49, 59 and 69 were cancelled without prejudice by the response filed August 20, 2007. Claims 1-6, 8-16, 18-26, 29-41, 43-48, 51-58, 60-68 and 71-78 stand rejected and are appealed herein.

(4) Status of Amendments

No claim amendments have been filed after final rejection.

(5) Summary of Claimed Subject Matter

Independent claim 1 includes an input to receive a signal (see e.g., Specification at page 6, line 21, to page 7, line 1; at page 11, lines 2-10; and at drawing reference #'s 200, 210, 220, 230, 400, 410); a buffer responsive to the input to store the signal (see e.g., Specification at page 7, lines 11-12; at page 11, line 25, to page 12, line 10; and at drawing reference #'s 250, 450); a detector responsive to the input to interpret the signal as discrete values (see e.g., Specification at page 7, lines 2-11; at page 11, lines 18-20; and at drawing reference #'s 240, 430); an averaging circuit responsive to the buffer and the detector to cause interpretation, by the detector during a retry mode, of a new signal comprising an average of a previous signal stored in the buffer and a current signal (see e.g., Specification at page 7, lines 14-19; at page 11, lines 23-25; and at drawing reference #'s 260, 400); a control circuit that determines whether the discrete values are adequately indicated based on output of the detector, that initiates the retry mode when the discrete values are not adequately indicated, and that determines whether the discrete values are adequately indicated from the interpretation of the new signal in the retry mode (see e.g., Specification at page 7, line 12, to page 8, line 3; and at drawing reference #'s 270, 370, 380, 400); and an error correction circuit responsive to the detector and the averaging circuit to provide a signal quality metric that governs which signals are averaged (see e.g., Specification at page 8, lines 11-23; at page 11, lines 20-22; and at drawing reference # 440).

Independent claim 9 includes an input to receive a signal (see e.g., Specification at page 6, line 21, to page 7, line 1; at page 11, lines 2-10; and at drawing reference #'s 200, 210, 220, 230, 400, 410); a buffer responsive to the input to store the signal (see e.g., Specification at page 7, lines 11-12; at page 11, line 25, to page 12, line 10; and at drawing reference #'s 250, 450); a detector responsive to the input to interpret the signal as discrete values (see e.g., Specification at page 7, lines 2-11; at page 11, lines 18-20; and at drawing reference #'s 240, 430); an averaging circuit responsive to the buffer and the detector to cause interpretation, by the detector during a retry mode, of a new signal comprising an average of a previous signal stored in the buffer and a current signal (see e.g., Specification at page 7, lines 14-19; at page 11, lines 23-25; and at drawing reference #'s 260, 400); and a control circuit that determines whether the discrete values are adequately indicated based on output of the detector, that initiates the retry mode when the

discrete values are not adequately indicated, and that determines whether the discrete values are adequately indicated from the interpretation of the new signal in the retry mode (see e.g., Specification at page 7, line 12, to page 8, line 3; and at drawing reference #'s 270, 370, 380, 400); wherein the control circuit determines whether the discrete values are adequately indicated based on comparison of interpretations of the new averaged signal and the current signal (see e.g., Specification at page 8, lines 4-10; and at drawing reference #'s 270, 370, 380, 400).

Independent claim 12 includes a storage medium (see e.g., Specification at page 6, lines 14-20; at page 9, lines 6-18; and at drawing reference #'s 200, 310); a head assembly operable to generate a read signal from the storage medium (see e.g., Specification at page 6, lines 21-23; at page 9, line 6, to page 10, line 2; and at drawing reference #'s 210, 320); a buffer that saves the read signal generated by the head assembly (see e.g., Specification at page 7, lines 11-12; at page 11, line 25, to page 12, line 10; and at drawing reference #'s 250, 450); a detector that interprets the read signal as discrete values (see e.g., Specification at page 7, lines 2-11; at page 11, lines 18-20; and at drawing reference #'s 240, 430); an averaging circuit responsive to the buffer and the detector (see e.g., Specification at page 7, lines 14-19; at page 11, lines 23-25; and at drawing reference #'s 260, 400); a control circuit responsive to the averaging circuit to determine whether the discrete values are adequately indicated based on output of the detector, initiate a retry mode when the discrete values are not adequately indicated, cause interpretation by the detector in the retry mode of a new read signal comprising an average of a previous read signal stored in the buffer and a current read signal, and determine whether the discrete values are adequately indicated from the interpretation of the new signal in the retry mode (see e.g., Specification at page 7, line 12, to page 8, line 3; and at drawing reference #'s 270, 370, 380, 400); and an error correction circuit responsive to the detector and the averaging circuit to provide a signal quality metric that governs which read signals are averaged (see e.g., Specification at page 8, lines 11-23; at page 11, lines 20-22; and at drawing reference # 440).

Independent claim 19 includes a storage medium (see e.g., Specification at page 6, lines 14-20; at page 9, lines 6-18; and at drawing reference #'s 200, 310); a head assembly operable to generate a read signal from the storage medium (see e.g., Specification at page 6, lines 21-23; at

page 9, line 6, to page 10, line 2; and at drawing reference #'s 210, 320); a buffer that saves the read signal generated by the head assembly (see e.g., Specification at page 7, lines 11-12; at page 11, line 25, to page 12, line 10; and at drawing reference #'s 250, 450); a detector that interprets the read signal as discrete values (see e.g., Specification at page 7, lines 2-11; at page 11, lines 18-20; and at drawing reference #'s 240, 430); an averaging circuit responsive to the buffer and the detector (see e.g., Specification at page 7, lines 14-19; at page 11, lines 23-25; and at drawing reference #'s 260, 400); and a control circuit responsive to the averaging circuit to determine whether the discrete values are adequately indicated based on output of the detector, initiate a retry mode when the discrete values are not adequately indicated, cause interpretation by the detector in the retry mode of a new read signal comprising an average of a previous read signal stored in the buffer and a current read signal, and determine whether the discrete values are adequately indicated from the interpretation of the new signal in the retry mode (see e.g., Specification at page 7, line 12, to page 8, line 3; and at drawing reference #'s 270, 370, 380, 400); wherein the control circuit determines whether the discrete values are adequately indicated based on comparison of interpretations of the new averaged read signal and the current read signal (see e.g., Specification at page 8, lines 4-10; and at drawing reference #'s 270, 370, 380, 400).

Independent claim 22 includes interpreting an input signal as discrete values (see e.g., Specification at page 4, lines 6-11; at page 12, lines 11-17; and at drawing reference #'s 100, 500, 520); deciding whether the discrete values have been adequately interpreted from the input signal (see e.g., Specification at page 4, line 11, to page 5, line 3; at page 12, lines 17-19; and at drawing reference # 530); entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal (see e.g., Specification at page 5, lines 3-9; at page 6, lines 1-3; at page 12, lines 21-23; and at drawing reference # 110); and averaging, in the retry mode, multiple signals to improve interpretation of the input signal (see e.g., Specification at page 5, lines 3-9; at page 12, lines 23-24; and at drawing reference # 110) including: obtaining a second signal representing same data as the input signal (see e.g., Specification at page 5, lines 10-19; at page 12, line 23; and at drawing reference # 540), averaging the input signal and the second signal to produce an averaged signal and to improve

signal interpretation (see e.g., Specification at page 5, lines 19-23; at page 12, lines 23-24; and at drawing reference # 550), interpreting the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 12, line 24, to page 13, line 1; and at drawing reference # 560), and determining whether the discrete values are adequately indicated based on the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 12, line 24, to page 13, line 1; and at drawing reference # 560); wherein interpreting the input signal comprises using maximum likelihood detection and error correction to provide the discrete values and a signal quality metric, the method further comprising excluding the input signal from the multiple signals to be averaged based on the signal quality metric (see e.g., Specification at page 7, lines 5-10; at page 8, lines 11-23; at page 13, lines 9-11; and at drawing reference # 550).

Independent claim 30 includes interpreting an input signal as discrete values (see e.g., Specification at page 4, lines 6-11; at page 12, lines 11-17; and at drawing reference #'s 100, 500, 520); deciding whether the discrete values have been adequately interpreted from the input signal (see e.g., Specification at page 4, line 11, to page 5, line 3; at page 12, lines 17-19; and at drawing reference # 530); entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal (see e.g., Specification at page 5, lines 3-9; at page 6, lines 1-3; at page 12, lines 21-23; and at drawing reference # 110); and averaging, in the retry mode, multiple signals to improve interpretation of the input signal (see e.g., Specification at page 5, lines 3-9; at page 12, lines 23-24; and at drawing reference # 110) including: obtaining a second signal representing same data as the input signal (see e.g., Specification at page 5, lines 10-19; at page 12, line 23; and at drawing reference # 540), averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation (see e.g., Specification at page 5, lines 19-23; at page 12, lines 23-24; and at drawing reference # 550), interpreting the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 12, line 24, to page 13, line 1; and at drawing reference # 560), and determining whether the discrete values are adequately indicated based on the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 12, line 24, to page 13, line 1; and at drawing reference # 560); wherein determining whether the discrete values are adequately indicated

comprises comparing interpretations of the averaged signal and of the second signal (see e.g., Specification at page 8, lines 4-10; at page 13, lines 12-22; and at drawing reference # 560).

Independent claim 34 includes means for storing data (see e.g., Specification at page 6, line 14, to page 7, line 1; at page 9, lines 6-18; at page 11, lines 2-10; and at drawing reference #'s 200, 310); and means for reading the data (see e.g., Specification at page 6, lines 21-23; at page 9, line 6, to page 10, line 2; and at drawing reference #'s 210-270, 320-450), said means for reading including: means for interpreting an input signal as discrete values (see e.g., Specification at page 4, lines 6-11; at page 7, lines 2-11; at page 11, lines 18-20; at page 12, lines 11-17; and at drawing reference #'s 240, 430); means for deciding whether the discrete values have been adequately interpreted from the input signal (see e.g., Specification at page 4, line 11, to page 5, line 3; at page 7, line 12, to page 8, line 3; at page 12, lines 17-19; and at drawing reference #'s 270, 370, 380, 400); means for entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal (see e.g., Specification at page 5, lines 3-9; at page 6, lines 1-3; at page 7, line 11, to page 8, line 3; at page 12, lines 21-23; and at drawing reference #'s 110, 270, 370, 380, 400); and means for averaging, in the retry mode, multiple read signals to improve data reading (see e.g., Specification at page 5, lines 3-9; at page 7, lines 11-19; at page 11, line 23, to page 12, line 10; at page 12, lines 23-24; and at drawing reference #'s 110, 250, 260, 400) including: means for obtaining a second signal representing same data as the input signal (see e.g., Specification at page 5, lines 10-19; at page 6, lines 21-23; at page 9, line 6, to page 10, line 2; at page 12, line 23; and at drawing reference #'s 210-270, 320-450, 540), means for averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation (see e.g., Specification at page 5, lines 19-23; at page 7, lines 11-19; at page 11, line 23, to page 12, line 10; at page 12, lines 23-24; and at drawing reference #'s 250, 260, 400, 550), means for interpreting the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 7, lines 2-11; at page 11, lines 18-20; at page 12, line 24, to page 13, line 1; and at drawing reference #'s 240, 430, 560), and means for determining whether the discrete values are adequately indicated based on the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 7, line 12, to page 8, line 3; at page 12, line 24, to page 13, line 1; and at drawing reference #'s 270, 370, 380, 400, 560); wherein the means

for reading further includes error-detection means for controlling which read signals are averaged (see e.g., Specification at page 7, lines 5-10; at page 8, lines 11-23; at page 11, lines 20-22; at page 13, lines 9-11; and at drawing reference #'s 440, 550).

Independent claim 43 includes means for storing data (see e.g., Specification at page 6, line 14, to page 7, line 1; at page 9, lines 6-18; at page 11, lines 2-10; and at drawing reference #'s 200, 310); and means for reading the data (see e.g., Specification at page 6, lines 21-23; at page 9, line 6, to page 10, line 2; and at drawing reference #'s 210-270, 320-450), said means for reading including: means for interpreting an input signal as discrete values (see e.g., Specification at page 4, lines 6-11; at page 7, lines 2-11; at page 11, lines 18-20; at page 12, lines 11-17; and at drawing reference #'s 240, 430); means for deciding whether the discrete values have been adequately interpreted from the input signal (see e.g., Specification at page 4, line 11, to page 5, line 3; at page 7, line 12, to page 8, line 3; at page 12, lines 17-19; and at drawing reference #'s 270, 370, 380, 400); means for entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal (see e.g., Specification at page 5, lines 3-9; at page 6, lines 1-3; at page 7, line 11, to page 8, line 3; at page 12, lines 21-23; and at drawing reference #'s 110, 270, 370, 380, 400); and means for averaging, in the retry mode, multiple read signals to improve data reading (see e.g., Specification at page 5, lines 3-9; at page 7, lines 11-19; at page 11, line 23, to page 12, line 10; at page 12, lines 23-24; and at drawing reference #'s 110, 250, 260, 400) including: means for obtaining a second signal representing same data as the input signal (see e.g., Specification at page 5, lines 10-19; at page 6, lines 21-23; at page 9, line 6, to page 10, line 2; at page 12, line 23; and at drawing reference #'s 210-270, 320-450, 540), means for averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation (see e.g., Specification at page 5, lines 19-23; at page 7, lines 11-19; at page 11, line 23, to page 12, line 10; at page 12, lines 23-24; and at drawing reference #'s 250, 260, 400, 550), means for interpreting the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 7, lines 2-11; at page 11, lines 18-20; at page 12, line 24, to page 13, line 1; and at drawing reference #'s 240, 430, 560), and means for determining whether the discrete values are adequately indicated based on the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 7, line 12, to page 8, line 3; at page 12, line

24, to page 13, line 1; and at drawing reference #'s 270, 370, 380, 400, 560); wherein the means for reading further includes means for comparing an averaged read signal and a current read signal (see e.g., Specification at page 8, lines 4-10; at page 13, lines 12-22; and at drawing reference #'s 270, 370, 380, 400, 560).

Independent claim 45 includes means for interpreting an input signal as discrete values (see e.g., Specification at page 4, lines 6-11; at page 7, lines 2-11; at page 11, lines 18-20; at page 12, lines 11-17; and at drawing reference #'s 240, 430); means for deciding whether the discrete values have been adequately interpreted from the input signal (see e.g., Specification at page 4, line 11, to page 5, line 3; at page 7, line 12, to page 8, line 3; at page 12, lines 17-19; and at drawing reference #'s 270, 370, 380, 400); means for entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal (see e.g., Specification at page 5, lines 3-9; at page 6, lines 1-3; at page 7, line 11, to page 8, line 3; at page 12, lines 21-23; and at drawing reference #'s 110, 270, 370, 380, 400); and means for averaging, in the retry mode, multiple signals to improve interpretation of the input signal (see e.g., Specification at page 5, lines 3-9; at page 7, lines 11-19; at page 11, line 23, to page 12, line 10; at page 12, lines 23-24; and at drawing reference #'s 110, 250, 260, 400) including: means for obtaining a second signal representing same data as the input signal (see e.g., Specification at page 5, lines 10-19; at page 6, lines 21-23; at page 9, line 6, to page 10, line 2; at page 12, line 23; and at drawing reference #'s 210-270, 320-450, 540), means for averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation (see e.g., Specification at page 5, lines 19-23; at page 7, lines 11-19; at page 11, line 23, to page 12, line 10; at page 12, lines 23-24; and at drawing reference #'s 250, 260, 400, 550), means for interpreting the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 7, lines 2-11; at page 11, lines 18-20; at page 12, line 24, to page 13, line 1; and at drawing reference #'s 240, 430, 560), and means for determining whether the discrete values are adequately indicated based on the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 7, line 12, to page 8, line 3; at page 12, line 24, to page 13, line 1; and at drawing reference #'s 270, 370, 380, 400, 560); wherein the means for interpreting comprises maximum likelihood detection and error correction means for providing the discrete values and a signal quality metric used to exclude an

input signal from averaging (see e.g., Specification at page 7, lines 5-10; at page 8, lines 11-23; at page 11, lines 20-22; at page 13, lines 9-11; and at drawing reference # 240, 430, 440, 550, 560).

Independent claim 52 includes means for interpreting an input signal as discrete values (see e.g., Specification at page 4, lines 6-11; at page 7, lines 2-11; at page 11, lines 18-20; at page 12, lines 11-17; and at drawing reference #'s 240, 430); means for deciding whether the discrete values have been adequately interpreted from the input signal (see e.g., Specification at page 4, line 11, to page 5, line 3; at page 7, line 12, to page 8, line 3; at page 12, lines 17-19; and at drawing reference #'s 270, 370, 380, 400); means for entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal (see e.g., Specification at page 5, lines 3-9; at page 6, lines 1-3; at page 7, line 11, to page 8, line 3; at page 12, lines 21-23; and at drawing reference #'s 110, 270, 370, 380, 400); and means for averaging, in the retry mode, multiple signals to improve interpretation of the input signal (see e.g., Specification at page 5, lines 3-9; at page 7, lines 11-19; at page 11, line 23, to page 12, line 10; at page 12, lines 23-24; and at drawing reference #'s 110, 250, 260, 400) including: means for obtaining a second signal representing same data as the input signal (see e.g., Specification at page 5, lines 10-19; at page 6, lines 21-23; at page 9, line 6, to page 10, line 2; at page 12, line 23; and at drawing reference #'s 210-270, 320-450, 540), means for averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation (see e.g., Specification at page 5, lines 19-23; at page 7, lines 11-19; at page 11, line 23, to page 12, line 10; at page 12, lines 23-24; and at drawing reference #'s 250, 260, 400, 550), means for interpreting the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 7, lines 2-11; at page 11, lines 18-20; at page 12, line 24, to page 13, line 1; and at drawing reference #'s 240, 430, 560), and means for determining whether the discrete values are adequately indicated based on the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 7, line 12, to page 8, line 3; at page 12, line 24, to page 13, line 1; and at drawing reference #'s 270, 370, 380, 400, 560); wherein the means for determining comprises means for comparing interpretations of the averaged signal and of the second signal (see e.g., Specification at page 8, lines 4-10; at page 13, lines 12-22; and at drawing reference #'s 270, 370, 380, 400, 560).

Independent claim 53 includes means for receiving a signal (see e.g., Specification at page 6, line 21, to page 7, line 1; at page 11, lines 2-10; and at drawing reference #'s 200-270, 310-450); means for storing the signal (see e.g., Specification at page 7, lines 11-12; at page 11, line 25, to page 12, line 10; and at drawing reference #'s 250, 450, 510); means for interpreting the signal as discrete values (see e.g., Specification at page 7, lines 2-11; at page 11, lines 18-20; and at drawing reference #'s 240, 430); retry-mode means for interpreting a new signal comprising an average of a stored signal and a current signal (see e.g., Specification at page 7, lines 14-19; at page 11, lines 23-25; and at drawing reference #'s 240, 260, 270, 370, 380, 400, 530-560); means for determining whether the discrete values are adequately indicated based on output of the means for interpreting, initiating the retry-mode means when the discrete values are not adequately indicated, and determining whether the discrete values are adequately indicated from the interpretation of the new signal by the retry-mode means (see e.g., Specification at page 7, line 12, to page 8, line 3; and at drawing reference #'s 240, 260, 270, 370, 380, 400, 530-560); and means for providing a signal quality metric that governs which signals are averaged (see e.g., Specification at page 8, lines 11-23; at page 11, lines 20-22; and at drawing reference # 440, 550).

Independent claim 61 includes means for receiving a signal (see e.g., Specification at page 6, line 21, to page 7, line 1; at page 11, lines 2-10; and at drawing reference #'s 200-270, 310-450); means for storing the signal (see e.g., Specification at page 7, lines 11-12; at page 11, line 25, to page 12, line 10; and at drawing reference #'s 250, 450, 510); means for interpreting the signal as discrete values (see e.g., Specification at page 7, lines 2-11; at page 11, lines 18-20; and at drawing reference #'s 240, 430); retry-mode means for interpreting a new signal comprising an average of a stored signal and a current signal (see e.g., Specification at page 7, lines 14-19; at page 11, lines 23-25; and at drawing reference #'s 240, 260, 270, 370, 380, 400, 530-560); and means for determining whether the discrete values are adequately indicated based on output of the means for interpreting, initiating the retry-mode means when the discrete values are not adequately indicated, and determining whether the discrete values are adequately indicated from the interpretation of the new signal by the retry-mode means (see e.g.,

Specification at page 7, line 12, to page 8, line 3; and at drawing reference #'s 240, 260, 270, 370, 380, 400, 530-560); wherein the means for determining comprises means for determining whether the discrete values are adequately indicated based on comparison of interpretations of the averaged signal and the current signal (see e.g., Specification at page 8, lines 4-10; and at drawing reference #'s 240, 260, 270, 370, 380, 400, 530-560).

Independent claim 64 includes interpreting an input signal as discrete values (see e.g., Specification at page 4, lines 6-11; at page 12, lines 11-17; and at drawing reference #'s 100, 500, 520); deciding whether the discrete values have been adequately interpreted from the input signal (see e.g., Specification at page 4, line 11, to page 5, line 3; at page 12, lines 17-19; and at drawing reference # 530); entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal (see e.g., Specification at page 5, lines 3-9; at page 6, lines 1-3; at page 12, lines 21-23; and at drawing reference # 110); and averaging, in the retry mode, multiple signals to improve interpretation of the input signal (see e.g., Specification at page 5, lines 3-9; at page 12, lines 23-24; and at drawing reference # 110) including: obtaining a second signal representing same data as the input signal (see e.g., Specification at page 5, lines 10-19; at page 12, line 23; and at drawing reference # 540), averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation (see e.g., Specification at page 5, lines 19-23; at page 12, lines 23-24; and at drawing reference # 550), interpreting the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 12, line 24, to page 13, line 1; and at drawing reference # 560), and determining whether the discrete values are adequately indicated based on the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 12, line 24, to page 13, line 1; and at drawing reference # 560); wherein interpreting the input signal comprises using maximum likelihood detection and error correction to provide the discrete values and a signal quality metric, and the operations further comprise excluding the input signal from the multiple signals to be averaged based on the signal quality metric (see e.g., Specification at page 7, lines 5-10; at page 8, lines 11-23; at page 13, lines 9-11; and at drawing reference # 550).

Independent claim 72 includes interpreting an input signal as discrete values (see e.g., Specification at page 4, lines 6-11; at page 12, lines 11-17; and at drawing reference #'s 100, 500, 520); deciding whether the discrete values have been adequately interpreted from the input signal (see e.g., Specification at page 4, line 11, to page 5, line 3; at page 12, lines 17-19; and at drawing reference # 530); entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal (see e.g., Specification at page 5, lines 3-9; at page 6, lines 1-3; at page 12, lines 21-23; and at drawing reference # 110); and averaging, in the retry mode, multiple signals to improve interpretation of the input signal (see e.g., Specification at page 5, lines 3-9; at page 12, lines 23-24; and at drawing reference # 110) including: obtaining a second signal representing same data as the input signal (see e.g., Specification at page 5, lines 10-19; at page 12, line 23; and at drawing reference # 540), averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation (see e.g., Specification at page 5, lines 19-23; at page 12, lines 23-24; and at drawing reference # 550), interpreting the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 12, line 24, to page 13, line 1; and at drawing reference # 560), and determining whether the discrete values are adequately indicated based on the averaged signal (see e.g., Specification at page 6, lines 3-12; at page 12, line 24, to page 13, line 1; and at drawing reference # 560); wherein determining whether the discrete values are adequately indicated comprises comparing interpretations of the averaged signal and of the second signal (see e.g., Specification at page 8, lines 4-10; at page 13, lines 12-22; and at drawing reference # 560).

(6) Grounds of Rejection to be Reviewed on Appeal

I. Claims 1, 2, 9-12, 19-24, 26, 30-35, 43-46, 52-54, 61-66, 68 and 72-78 stand rejected under 35 U.S.C. §102(e) as allegedly being anticipated by U.S. Patent No. 7,136,244 issued to Rothberg (hereinafter "Rothberg").

II. Claims 3-6, 8, 13-16, 18, 25, 29, 36-41, 47, 48, 51, 55-58, 60, 67 and 71 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Rothberg and further in view of U.S. Patent No. 6,519,715 issued to Takashi et al. (hereinafter "Takashi").

(7) Argument

I. Rejection under 35 USC § 102(e): Rothberg fails to describe the claimed subject matter.

A. Claims 1, 2, 11, 12, 21-24, 26, 33-35, 45-46, 53-54, 63-68, 75 and 78: Rothberg fails to teach or suggest at least an error correction circuit responsive to the detector and the averaging circuit to provide a signal quality metric that governs which signals are averaged.

Independent claim 1 recites, among other things, "an error correction circuit responsive to the detector and the averaging circuit to provide a signal quality metric that governs **which signals are averaged**." (Emphasis added.) For example, as described in the present specification:

> [0024] A quality monitor can be used to measure signal quality for use in reading the data. The quality measure can be based on a defined signal characteristic. **Averaging can be based on the quality measure**, **such as by excluding a read signal with a low quality measure** from the averaging[.] [...]
> [0038] **The signals that are averaged can vary.** [...] **obtained signals can be excluded from the averaging based on a signal quality metric**[.]

(*See* Specification at page 8, lines 11-17; and at page 13, lines 2-11; emphasis added.) The plain meaning of the language of claim 1, in light of the specification, is that at least one of the signals is not included in the averaged signal, based on the signal quality metric.

The Office relies on Rothberg for this claimed subject matter, referring to FIG. 4 and col. 4, lines 1-58 in Rothberg. (*See* 4-30-2008 Final Office Action at pages 3 and 6.) However, Rothberg fails to describe the claimed subject matter. Rothberg makes clear that each new signal is averaged into a running average of all previous signals from the same data sector:

> The binary bits 26 detected during the read operation are averaged with the binary bits stored in the buffer 10 to generate averaged binary bits. The disk controller 12 processes the averaged binary bits stored in the buffer 10 in an attempt to recover the data sector. If the data sector is still unrecoverable, another retry operation is executed and the detected binary bits 26 are averaged with the binary bits stored in the buffer 10. **<u>This process is reiterated until the data sector is recovered, or the data sector is deemed unrecoverable after a predetermined number of retries.</u>**

(*See* Rothberg at col. 3, lines 57-67; emphasis added.) Moreover, the later cited portion of Rothberg (FIG. 4 and col. 4, lines 27-58) describes generating a reliability metric for each ECC (error correction code) symbol relative to the weighted outcome of the averaging:

> In one embodiment, the averaged values used to assign the binary value to each averaged binary bit is also used to generate **<u>an erasure pointer for increasing the number of errors corrected by the error correction code 30</u>**. This is illustrated in FIG. 4 which shows a reliability metric generated for each bit in the estimated data sequence 34. **<u>The reliability metric in this embodiment is computed as the averaged value if assigned a "1" bit, and computed as one minus the average value if assigned a "0" bit.</u>** The first averaged binary bit 36_0 is assigned a "1" bit so a reliability metric of 3/5 or 0.6 is assigned to the first averaged binary bit 36_0. The second averaged binary bit 36_1 is assigned a "0" bit so a reliability metric of 1-1/5 or 0.8 is assigned to the second averaged binary bit 36_1. The remainder of the averaged binary bits 36_2-36_N are assigned a reliability metric in a similar manner. **<u>In the example of FIG. 4, the ECC symbols comprise three bits each, and the reliability metrics generated for each bit in a symbol are combined to generate the erasure pointers. In the example of FIG. 4, the reliability metrics are added and the result compared to a threshold. If the result is less than or equal to a threshold, then an erasure pointer is generated for the symbol.</u>** The combined metrics for the first symbol

> is 2.4 which is greater than 1.5 and therefore no erasure pointer is generated. The combined metrics for the last symbol is 1.4 which is less than 1.5 and therefore an erasure pointer is generated. Any suitable error correction code may be employed, such as a Reed-Solomon error correction code. Using erasure pointers to augment [...] an error correction code, such as a Reed-Solomon error correction code, is well known, the details of which are not disclosed so as not to obscure the embodiments of the present invention.

(*See* Rothberg at col. 4, lines 27-58; emphasis added.) Nothing here teaches or suggests at least an error correction circuit responsive to the detector and the averaging circuit to provide a signal quality metric **that governs which signals are averaged**. To the contrary, the signals to be averaged are already known when Rothberg's reliability metric is generated, and this reliability metric does not affect which signals are averaged together in Rothberg.

Furthermore, the earlier cited portion of Rothberg (FIG. 4 and col. 4, lines 1-27) **does not** teach or suggest a signal quality metric that governs which signals are averaged, as asserted by the Office. Rather, this portion of Rothberg describes a particular method (namely, using counters) for averaging all of the signals obtained:

> The averaging operation is illustrated in FIG. 2 as **a number of estimated data sequences 32_0-32_N averaged together to generate the estimated data sequence 34** comprising the averaged data bits. However, any suitable method may be employed to generate the averaged binary bits in the estimated data sequence 34. In one embodiment, the buffer 10 stores a count value for each occurrence of a "1" bit for each binary symbol. The count value for each "1" bit is then divided by the number of retries attempted. If the result of the division is greater or equal to 1/2, then the averaged binary bit in the estimated data sequence 34 is assigned a "1" bit, otherwise it is assigned a "0" bit. This is illustrated in FIG. 3 which shows an estimated data sequences 32_0 detected during an initial read operation, and four

> estimated data sequences 32_1-32_4 detected during four retry operations. **The binary bits in the estimated data sequences 32_0-32_4 are averaged together to generate the estimated data sequence 34** comprising averaged binary bits 36_0-36_N. The first averaged binary bit 36_0 is assigned a "1" bit since there are three "1" bits in the corresponding bit of the estimated data sequences 32_0-32_4, and 3/5 is greater than or equal to 1/2. The second averaged binary bit 36_1 is assigned a "0" bit since there is one "1" bit in the corresponding bit of the estimated data sequences 32_0-32_4, and 1/5 is not greater than or equal to 1/2. The remainder of the averaged binary bits 36_2-36_N are assigned a "1" or "0" in a similar manner.

(*See* Rothberg at col. 4, lines 1-27; emphasis added.) The use of count values and division for each data bit does not in any way teach or suggest at least an error correction circuit responsive to the detector and the averaging circuit to provide a signal quality metric **that governs which signals are averaged**. To the contrary, the signals to be averaged are already known to be **all** the obtained signals, which is why simple counters may be used to generate the average.

Thus, based on the arguments above, the rejection of claims 1, 2 and 11 should be withdrawn, and these claims should be in condition for allowance.

Independent claim 12 should be allowable for at least similar reasons. Claim 12 recites, among other things, "an error correction circuit responsive to the detector and the averaging circuit to provide **a signal quality metric that governs which read signals are averaged**." (Emphasis added.) The Office relies on Rothberg for this claimed subject matter, referring to the rejection of claim 1 when rejecting claim 12. (*See* 4-30-2008 Final Office Action at page 7.) Thus, for at least the reasons addressed above, Rothberg fails to teach or suggest an error correction circuit responsive to the detector and the averaging circuit to provide a signal quality metric that governs **which read signals** are averaged. Thus, based on the arguments above, the

rejection of claims 12 and 21 should be withdrawn, and these claims should be in condition for allowance.

Independent claim 22 should also be allowable for at least reasons similar to claim 1. Claim 22 recites, among other things, "wherein interpreting the input signal comprises using maximum likelihood detection and error correction to provide the discrete values and **a signal quality metric**, the method further comprising **excluding the input signal from the multiple signals to be averaged based on the signal quality metric**." (Emphasis added.) The Office relies on Rothberg and the rejection of claim 1 for this claimed subject matter, referring to the rejection of claim 1 when rejecting claim 22. (*See* 4-30-2008 Final Office Action at page 7.) However, the specific language of claim 22 ("excluding the input signal from the multiple signals to be averaged based on the signal quality metric") has only been tangentially addressed by the Office's statement that:

> The applicant is referred again to FIG. 4, wherein Rothberg teaches the signals that are averaged (reference character 34) from obtained signals (reference characters (32_0) through (32_4) can be excluded from the averaging based on a signal quality metric. Simply and obviously, if signal quality metric has a value of "0.0" that signal would be excluded from averaging.

(*See* 4-30-2008 Final Office Action at page 3.) With all due respect, this contention defies common sense. First, the reference characters (32_0) through (32_4) correspond to the estimated data sequences and **do not** constitute a signal quality metric; it appears that the Examiner is confusing the input signal with the signal quality metric that corresponds to that input signal. Second, if an estimated data sequence has a value of "0.0", this **does not mean** that the data sequence is excluded from the average. To the contrary, such zero values are clearly included in

the average being calculated in Rothberg since there is no other way that the averaged value for a sequence bit could have the range of zero to one, as explicitly described in Rothberg. (*See* Rothberg at col. 4, lines 1-27.) Thus, based on the arguments above, the rejection of claims 22-24, 26 and 33 should be withdrawn, and these claims should be in condition for allowance.

Independent claim 34 should also be allowable for at least reasons similar to claim 1. Claim 34 recites, among other things, "wherein the means for reading further includes error-detection means for **controlling which read signals are averaged**." (Emphasis added.) The Office relies on Rothberg, and the rejection of claims 1 and 22, for this claimed subject matter. (*See* 4-30-2008 Final Office Action at pages 7 and 9.) Thus, the remarks above with respect to claims 1 and 22 are applicable to claim 34 as well. Therefore, based on the arguments above, the rejection of claims 34 and 35 should be withdrawn, and these claims should be in condition for allowance.

Independent claim 45 should also be allowable for at least similar reasons. Claim 45 recites, among other things, "wherein the means for interpreting comprises maximum likelihood detection and error correction means for providing the discrete values and **a signal quality metric used to exclude an input signal from averaging**." (Emphasis added.) The Office relies on Rothberg, and the rejection of claims 1 and 22, for this claimed subject matter. (*See* 4-30-2008 Final Office Action at pages 7 and 9.) For at least reasons similar to those addressed above, Rothberg fails to teach or suggest a signal quality metric used to exclude an input signal from averaging. Thus, based on the arguments above, the rejection of claims 45, 46 and 78 should be withdrawn, and these claims should be in condition for allowance.

Independent claim 53 should also be allowable for at least reasons similar to claim 1. Claim 53 recites, among other things, "means for providing a signal quality metric that **governs which signals are averaged**." (Emphasis added.) The Office relies on Rothberg and the rejection of claim 1, for this claimed subject matter, referring to the rejection of claim 1 when rejecting claim 53. (*See* 4-30-2008 Final Office Action at page 7.) Thus, the remarks above with respect to Rothberg are applicable to claim 53 as well. Therefore, based on the arguments above, the rejection of claims 53, 54 and 63 should be withdrawn, and these claims should be in condition for allowance.

Independent claim 64 should also be allowable for at least reasons similar to claim 45. Claim 64 recites, among other things, "wherein interpreting the input signal comprises using maximum likelihood detection and error correction to provide the discrete values and a signal quality metric, and the operations further comprise **excluding the input signal from the multiple signals to be averaged based on the signal quality metric**." (Emphasis added.) The Office relies on Rothberg, and the rejection of claims 1 and 22, for this claimed subject matter. (*See* 4-30-2008 Final Office Action at pages 7 and 9.) For at least reasons similar to those addressed above, Rothberg fails to teach or suggest excluding the input signal from the multiple signals to be averaged based on the signal quality metric. Thus, based on the arguments above, the rejection of claims 64-68 and 75 should be withdrawn, and these claims should be in condition for allowance.

B. Claims 9, 10, 19, 20, 30-32, 43, 44, 52, 61, 62, 72-74, 76 and 77: Rothberg fails to teach or suggest at least a control circuit that determines whether the discrete values are adequately indicated based on comparison of interpretations of the new averaged signal and the current signal.

Claims 9, 19, 30, 43, 52, 61 and 72 stand rejected under 35 U.S.C. 102(e) in view of Rothberg. However, the Office fails to provide any rationale for the rejection of these claims, but rather simply provides a bare citation to FIG. 4 and col. 4, lines 1-27, of Rothberg. (*See* 4-30-2008 Final Office Action at pages 4 and 7.) However, this portion of Rothberg (which is quoted in full at pages 15-16 above) has no relation to the claimed subject matter. The subject matter of claim 9 includes, "wherein the control circuit determines whether the discrete values are adequately indicated **based on comparison of interpretations of the new averaged signal and the current signal**." (Emphasis added.) For example, as described in the Specification:

> [0023] Determining whether the discrete values are adequately indicated can involve **comparing interpretations of the averaged read signal and a current read signal**. [...]
>
> [0039] Determining whether the discrete values are adequately indicated based on the averaged signal can involve different types of comparisons. The averaged signal can be interpreted directly, and the determination can be based solely on the interpreted averaged signal. Alternatively, the determination can involve a **comparison of interpretations of the averaged signal and of the current signal**.

(*See* Specification at page 8, lines 4-10; and at page 13, lines 12-22; emphasis added.) The cited portion of Rothberg describes a particular method (namely, using counters) for averaging all of the signals obtained. Rothberg fails to teach or suggest, in any fashion, the subject matter recited in independent claims 9, 19, 30, 43, 52, 61 and 72. Rather, Rothberg teaches:

> As shown in the flow diagram of FIG. 1B, at step 14 the disk controller 12 positions the head 8 over a selected data sector to generate a first read signal and at step 16 stores in the buffer 10 first read data associated with the first read signal. **If** at step 18 **a read error occurs**, the disk controller 12 repositions the head over the selected data sector at step 19 to **generate a second read signal**. At step 20 second read data associated with the second read signal is **averaged with the first read data** stored in the buffer 10 **to generate averaged read data**. **The average read data is** stored in the buffer 10 and **processed** at step 22 **to recover the selected data sector**.
>
> [...] **If the data sector is still unrecoverable, another retry operation is executed** and the detected binary bits 26 are averaged with the binary bits stored in the buffer 10. **This process is reiterated until the data sector is recovered**, or the data sector is deemed unrecoverable after a predetermined number of retries.

(*See* Rothberg at col. 3, lines 32-67; emphasis added.) Thus, Rothberg teaches assessing a read error based on the original signal **or** a later averaged signal.

Rothberg fails to teach or suggest a control circuit that "determines whether the discrete values are adequately indicated based on comparison of interpretations of the new averaged signal and the current signal." Thus, based on the arguments above, the rejection of claims 9, 10, 19, 20, 30-32, 43, 44, 52, 61, 62, 72-74, 76 and 77 should be withdrawn, and these claims should be in condition for allowance.

In view of the arguments presented above, it is respectfully requested that ground of rejection I be overturned in its entirety.

II. Rejection under 35 USC § 103(a): Takashi fails to cure the defects of Rothberg.

Takashi fails to describe the claimed subject matter addressed above with respect to Rothberg. Takashi focuses on reducing latency and teaches reading a disk again by doing a synchronized addition to the same sector. (*See* Takashi at col. 27, lines 45-59.) Takashi automatically reads the disk when the sector comes around again and automatically averages the new read signal with the stored read signal to reduce signal to noise ratio. Takashi describes a maximum likelihood (ML) detector circuit 13 that interprets this averaged signal:

> Sampled data from the pertinent sector is previously stored in FIFO 6. Specifically, as can be seen from FIG. 36, signal of the pertinent sector is **obtained at each time**, because the media 54 has rotated constantly. A sector signal recorded on a track is stored as sampled data in FIFO 6 through AD circuit 4 to AGC circuit 12. Next, when media 54 makes one turn and the signal of the same sector are reproduced, average circuit 250 calculates an average of current data coming from AGC circuit 12 and the sampled data of the previous read operation in FIFO 6. The average operation is started after sync byte data, therefore, the operation is conducted as **a synchronized addition for the same sector**. Namely, without changing the signal amplitude, only noise superimposed onto the signal is attenuated by a square root of 1/2. As a result, the signal-to-noise ratio of the sampled data supplied to ML detector circuit 13 is improved only 3 dB. That is, it is possible to reproduce signals having a lower signal-to-noise ratio.

(*See* Takashi at col. 27, lines 46-63; emphasis added.) Nothing here (or elsewhere in Takashi) teaches or suggests an error correction circuit responsive to the detector and the averaging circuit to provide a signal quality metric **that governs which signals are averaged**. Likewise, nothing here (or elsewhere in Takashi) teaches or suggests a control circuit that "determines whether the discrete values are adequately indicated based on comparison of interpretations of the new

averaged signal and the current signal." Thus, Takashi fails to cure the deficiencies addressed above with respect to Rothberg.

Therefore, based on the arguments presented above with respect to claim 1, the rejection of claims 3-6 and 8 should be withdrawn, and these claims should be in condition for allowance. Based on the arguments presented above with respect to claim 12, the rejection of claims 13-16 and 18 should be withdrawn, and these claims should be in condition for allowance. Based on the arguments presented above with respect to claim 22, the rejection of claims 25 and 29 should be withdrawn, and these claims should be in condition for allowance. Based on the arguments presented above with respect to claim 34, the rejection of claims 36-41 should be withdrawn, and these claims should be in condition for allowance. Based on the arguments presented above with respect to claim 45, the rejection of claims 47, 48 and 51 should be withdrawn, and these claims should be in condition for allowance. Based on the arguments presented above with respect to claim 53, the rejection of claims 55-58 and 60 should be withdrawn, and these claims should be in condition for allowance. Finally, based on the arguments presented above with respect to claim 64, the rejection of claim 71 should be withdrawn, and this claim should be in condition for allowance.

In view of the arguments presented above, it is respectfully requested that ground of rejection II be overturned in its entirety.

Please apply the appeal brief fee, the one month extension of time fee, and any other necessary charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: Oct. 30, 2008

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Appendix of Claims

1. A signal processing apparatus comprising:

an input to receive a signal;

a buffer responsive to the input to store the signal;

a detector responsive to the input to interpret the signal as discrete values;

an averaging circuit responsive to the buffer and the detector to cause interpretation, by the detector during a retry mode, of a new signal comprising an average of a previous signal stored in the buffer and a current signal;

a control circuit that determines whether the discrete values are adequately indicated based on output of the detector, that initiates the retry mode when the discrete values are not adequately indicated, and that determines whether the discrete values are adequately indicated from the interpretation of the new signal in the retry mode; and

an error correction circuit responsive to the detector and the averaging circuit to provide a signal quality metric that governs which signals are averaged.

2. The apparatus of claim 1, wherein the signal from the input comprises a read signal received from a storage medium.

3. The apparatus of claim 1, wherein the signal from the input comprises an analog signal, the apparatus further comprising a filter and an analog-to-digital converter (ADC) coupled between the input and the detector.

4. The apparatus of claim 3, wherein the buffer is coupled between the ADC and the filter.

5. The apparatus of claim 3, wherein the buffer is coupled between the filter and the detector.

6. The apparatus of claim 3, wherein the filter comprises a finite impulse response (FIR) digital filter coupled between the ADC and the detector.

7. (Cancelled)

8. The apparatus of claim 1, wherein the detector comprises a Viterbi detector.

9. A signal processing apparatus, comprising:

an input to receive a signal;

a buffer responsive to the input to store the signal;

a detector responsive to the input to interpret the signal as discrete values;

an averaging circuit responsive to the buffer and the detector to cause interpretation, by the detector during a retry mode, of a new signal comprising an average of a previous signal stored in the buffer and a current signal; and

a control circuit that determines whether the discrete values are adequately indicated based on output of the detector, that initiates the retry mode when the discrete values are not adequately indicated, and that determines whether the discrete values are adequately indicated from the interpretation of the new signal in the retry mode;

wherein the control circuit determines whether the discrete values are adequately indicated based on comparison of interpretations of the new averaged signal and the current signal.

10. The apparatus of claim 9, wherein the control circuit causes averaging of a defined number of most recent input signals, wherein the defined number is greater than two.

11. The apparatus of claim 1, wherein the control circuit causes the previous signal stored in the buffer to be an averaged input signal when two or more signals are obtained in the retry mode.

12. A storage device, comprising:

a storage medium;

a head assembly operable to generate a read signal from the storage medium;

a buffer that saves the read signal generated by the head assembly;

a detector that interprets the read signal as discrete values;

an averaging circuit responsive to the buffer and the detector;

a control circuit responsive to the averaging circuit to determine whether the discrete values are adequately indicated based on output of the detector, initiate a retry mode when the discrete values are not adequately indicated, cause interpretation by the detector in the retry mode of a new read signal comprising an average of a previous read signal stored in the buffer and a current read signal, and determine whether the discrete values are adequately indicated from the interpretation of the new signal in the retry mode; and

an error correction circuit responsive to the detector and the averaging circuit to provide a signal quality metric that governs which read signals are averaged.

13. The storage device of claim 12, wherein the read signal comprises an analog read signal, the storage device further comprising a filter and an analog-to-digital converter (ADC) coupled between the head assembly and the detector.

14. The storage device of claim 13, wherein the buffer is coupled between the ADC and the filter.

15. The storage device of claim 13, wherein the buffer is coupled between the filter and the detector.

16. The storage device of claim 13, wherein the filter comprises a finite impulse response (FIR) digital filter coupled between the ADC and the detector.

17. (Cancelled)

18. The storage device of claim 12, wherein the detector comprises a Viterbi detector.

19. A storage device, comprising:

a storage medium;

a head assembly operable to generate a read signal from the storage medium;

a buffer that saves the read signal generated by the head assembly;

a detector that interprets the read signal as discrete values;

an averaging circuit responsive to the buffer and the detector; and

a control circuit responsive to the averaging circuit to determine whether the discrete

values are adequately indicated based on output of the detector, initiate a retry mode when the discrete values are not adequately indicated, cause interpretation by the detector in the retry mode of a new read signal comprising an average of a previous read signal stored in the buffer and a current read signal, and determine whether the discrete values are adequately indicated from the interpretation of the new signal in the retry mode;

wherein the control circuit determines whether the discrete values are adequately indicated based on comparison of interpretations of the new averaged read signal and the current read signal.

20. The storage device of claim 19, wherein the control circuit causes averaging of a defined number of most recent read signals, wherein the defined number is greater than two.

21. The storage device of claim 12, wherein the control circuit causes the previous read signal stored in the buffer to be an averaged read signal when two or more read attempts are made in the retry mode.

22. A method of reading data on a channel or media, the method comprising:

interpreting an input signal as discrete values;

deciding whether the discrete values have been adequately interpreted from the input signal;

entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal; and

averaging, in the retry mode, multiple signals to improve interpretation of the input signal

including:

obtaining a second signal representing same data as the input signal,

averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation,

interpreting the averaged signal, and

determining whether the discrete values are adequately indicated based on the averaged signal;

wherein interpreting the input signal comprises using maximum likelihood detection and error correction to provide the discrete values and a signal quality metric, the method further comprising excluding the input signal from the multiple signals to be averaged based on the signal quality metric.

23. The method of claim 22, wherein interpreting the input signal comprises:

sampling the input signal;

storing the sampled input signal; and

detecting the discrete values in the sampled input signal.

24. The method of claim 23, wherein sampling the input signal comprises converting the input signal to a digital signal, storing the sampled input signal comprises storing the digital signal, and the multiple signals to be averaged include the stored digital signal.

25. The method of claim 23, wherein sampling the input signal comprises converting the input signal to a digital signal and filtering the digital signal based on finite impulse response,

storing the sampled input signal comprises storing the filtered digital signal, and the multiple signals to be averaged include the stored and filtered digital signal.

26. The method of claim 22, wherein the input signal comprises a read signal received from a storage medium, interpreting the input signal comprises determining if the read signal adequately indicates the discrete values, and averaging the multiple signals comprises averaging multiple read signals of the storage medium to improve read signal interpretation.

27. (Cancelled)

28. (Cancelled)

29. The method of claim 22, wherein determining whether the discrete values are adequately indicated comprises interpreting the averaged signal with a Viterbi detector.

30. A method of reading data on a channel or media, the method comprising:

interpreting an input signal as discrete values;

deciding whether the discrete values have been adequately interpreted from the input signal;

entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal; and

averaging, in the retry mode, multiple signals to improve interpretation of the input signal including:

obtaining a second signal representing same data as the input signal,

averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation,

interpreting the averaged signal, and

determining whether the discrete values are adequately indicated based on the averaged signal;

wherein determining whether the discrete values are adequately indicated comprises comparing interpretations of the averaged signal and of the second signal.

31. The method of claim 30, wherein averaging the multiple signals further comprises, in the retry mode, in response to the discrete values being inadequately indicated, repeatedly obtaining a new signal, averaging most recent signals to generate a newly averaged signal, and determining if the newly averaged signal adequately indicates the discrete values.

32. The method of claim 31, wherein averaging the most recent signals comprises averaging the three most recent signals.

33. The method of claim 22, wherein averaging the multiple signals further comprises, in the retry mode, in response to the discrete values being inadequately indicated, repeatedly obtaining a new signal, averaging the new signal with the previous averaged signal, and determining if the newly averaged signal adequately indicates the discrete values.

34. A system comprising:

means for storing data; and

means for reading the data, said means for reading including:

means for interpreting an input signal as discrete values;

means for deciding whether the discrete values have been adequately interpreted from the input signal;

means for entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal; and

means for averaging, in the retry mode, multiple read signals to improve data reading including:

means for obtaining a second signal representing same data as the input signal,

means for averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation,

means for interpreting the averaged signal, and

means for determining whether the discrete values are adequately indicated based on the averaged signal;

wherein the means for reading further includes error-detection means for controlling which read signals are averaged.

35. The system of claim 34, wherein the means for storing data comprises magnetic means for storing data.

36. The system of claim 34, wherein the means for averaging comprises means for saving a digital read signal before equalization in a read channel.

37. The system of claim 36, wherein the means for saving a digital read signal comprises means for saving an averaged read signal.

38. The system of claim 34, wherein the means for reading further includes means for converting the read signals to digital signals, means for filtering the digital signals, and means for detecting stored information in the filtered digital signals.

39. The system of claim 38, wherein the means for averaging comprises means for storing a read signal between the means for converting and the means for filtering.

40. The system of claim 38, wherein the means for averaging comprises means for storing a read signal between the means for filtering and the means for detecting.

41. The system of claim 38, wherein the means for detecting comprises Viterbi means for detecting stored information in the filtered digital signals.

42. (Cancelled)

43. A system comprising:

means for storing data; and

means for reading the data, said means for reading including:

means for interpreting an input signal as discrete values;

means for deciding whether the discrete values have been adequately interpreted from the input signal;

means for entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal; and

means for averaging, in the retry mode, multiple read signals to improve data reading including:

means for obtaining a second signal representing same data as the input signal,

means for averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation,

means for interpreting the averaged signal, and

means for determining whether the discrete values are adequately indicated based on the averaged signal;

wherein the means for reading further includes means for comparing an averaged read signal and a current read signal.

44. The system of claim 43, wherein the means for averaging comprises means for averaging three or more most recent read signals.

45. An article comprising:

means for interpreting an input signal as discrete values;

means for deciding whether the discrete values have been adequately interpreted from the input signal;

means for entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal; and

means for averaging, in the retry mode, multiple signals to improve interpretation of the

input signal including:

means for obtaining a second signal representing same data as the input signal,

means for averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation,

means for interpreting the averaged signal, and

means for determining whether the discrete values are adequately indicated based on the averaged signal;

wherein the means for interpreting comprises maximum likelihood detection and error correction means for providing the discrete values and a signal quality metric used to exclude an input signal from averaging.

46. The article of claim 45, wherein the means for interpreting comprises:

means for sampling the input signal;

means for storing the sampled input signal; and

means for detecting the discrete values in the sampled input signal.

47. The article of claim 46, wherein the means for sampling comprises means for converting the input signal to a digital signal, and the means for storing comprises means for storing the digital signal, and the means for averaging comprises means for averaging the stored digital signal and a current signal.

48. The article of claim 46, wherein the means for sampling comprises means for converting the input signal to a digital signal and means for filtering the digital signal based on

finite impulse response, and the means for storing comprises means for storing the filtered digital signal, and the means for averaging comprises means for averaging the stored and filtered digital signal and a current signal.

49. (Cancelled)

50. (Cancelled)

51. The article of claim 45, wherein the means for determining comprises Viterbi means for interpreting the averaged signal.

52. An article comprising:

means for interpreting an input signal as discrete values;

means for deciding whether the discrete values have been adequately interpreted from the input signal;

means for entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal; and

means for averaging, in the retry mode, multiple signals to improve interpretation of the input signal including:

means for obtaining a second signal representing same data as the input signal,

means for averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation,

means for interpreting the averaged signal, and

means for determining whether the discrete values are adequately indicated based on the

averaged signal;

wherein the means for determining comprises means for comparing interpretations of the averaged signal and of the second signal.

53. An apparatus comprising:

means for receiving a signal;

means for storing the signal;

means for interpreting the signal as discrete values;

retry-mode means for interpreting a new signal comprising an average of a stored signal and a current signal;

means for determining whether the discrete values are adequately indicated based on output of the means for interpreting, initiating the retry-mode means when the discrete values are not adequately indicated, and determining whether the discrete values are adequately indicated from the interpretation of the new signal by the retry-mode means; and

means for providing a signal quality metric that governs which signals are averaged.

54. The apparatus of claim 53, wherein the means for receiving comprises means for receiving a read signal from a storage medium.

55. The apparatus of claim 53, further comprising means for converting a received analog signal to a digital signal and means for filtering the digital signal.

56. The apparatus of claim 55, wherein the means for storing comprises means for buffering the digital signal.

57. The apparatus of claim 55, wherein the means for storing comprises means for buffering the filtered digital signal.

58. The apparatus of claim 55, wherein the means for filtering comprises a finite impulse response (FIR) digital filter.

59. (Cancelled)

60. The apparatus of claim 53, wherein the retry-mode means for interpreting comprises a Viterbi detector.

61. An apparatus comprising:

means for receiving a signal;

means for storing the signal;

means for interpreting the signal as discrete values;

retry-mode means for interpreting a new signal comprising an average of a stored signal and a current signal; and

means for determining whether the discrete values are adequately indicated based on output of the means for interpreting, initiating the retry-mode means when the discrete values are not adequately indicated, and determining whether the discrete values are adequately indicated from the interpretation of the new signal by the retry-mode means;

wherein the means for determining comprises means for determining whether the discrete values are adequately indicated based on comparison of interpretations of the averaged signal and the current signal.

62. The apparatus of claim 61, further comprising means for averaging a defined number of most recent input signals, wherein the defined number is greater than two.

63. The apparatus of claim 53, further comprising means for causing the stored signal to be an averaged input signal when two or more signals are obtained in a retry mode.

64. A machine-readable medium embodying information indicative of instructions for causing one or more machines to perform operations for reading data on a channel or media, the operations comprising:

interpreting an input signal as discrete values;

deciding whether the discrete values have been adequately interpreted from the input signal;

entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal; and

averaging, in the retry mode, multiple signals to improve interpretation of the input signal including:

obtaining a second signal representing same data as the input signal,

averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation,

interpreting the averaged signal, and

determining whether the discrete values are adequately indicated based on the averaged signal;

wherein interpreting the input signal comprises using maximum likelihood detection and

error correction to provide the discrete values and a signal quality metric, and the operations further comprise excluding the input signal from the multiple signals to be averaged based on the signal quality metric.

65. The machine-readable medium of claim 64, wherein interpreting the input signal comprises:

sampling the input signal;

storing the sampled input signal; and

detecting the discrete values in the sampled input signal.

66. The machine-readable medium of claim 65, wherein sampling the input signal comprises converting the input signal to a digital signal, storing the sampled input signal comprises storing the digital signal, and the multiple signals to be averaged include the stored digital signal.

67. The machine-readable medium of claim 65, wherein sampling the input signal comprises converting the input signal to a digital signal and filtering the digital signal based on finite impulse response, storing the sampled input signal comprises storing the filtered digital signal, and the multiple signals to be averaged include the stored and filtered digital signal.

68. The machine-readable medium of claim 64, wherein the input signal comprises a read signal received from a storage medium, interpreting the input signal comprises determining if the read signal adequately indicates the discrete values, and averaging the multiple signals

comprises averaging multiple read signals of the storage medium to improve read signal interpretation.

69. (Cancelled)

70. (Cancelled)

71. The machine-readable medium of claim 64, wherein determining whether the discrete values are adequately indicated comprises interpreting the averaged signal with a Viterbi detector.

72. A machine-readable medium embodying information indicative of instructions for causing one or more machines to perform operations for reading data on a channel or media, the operations comprising:

interpreting an input signal as discrete values;

deciding whether the discrete values have been adequately interpreted from the input signal;

entering a retry mode in response to a decision that the discrete values have not been adequately interpreted from the input signal; and

averaging, in the retry mode, multiple signals to improve interpretation of the input signal including:

obtaining a second signal representing same data as the input signal,

averaging the input signal and the second signal to produce an averaged signal and to improve signal interpretation,

interpreting the averaged signal, and

determining whether the discrete values are adequately indicated based on the averaged signal;

wherein determining whether the discrete values are adequately indicated comprises comparing interpretations of the averaged signal and of the second signal.

73. The machine-readable medium of claim 72, wherein averaging the multiple signals further comprises, in the retry mode, in response to the discrete values being inadequately indicated, repeatedly obtaining a new signal, averaging most recent signals, and determining if the newly averaged signal adequately indicates the discrete values.

74. The machine-readable medium of claim 73, wherein averaging the most recent signals comprises averaging the three most recent signals.

75. The machine-readable medium of claim 64, wherein averaging the multiple signals further comprises, in the retry mode, in response to the discrete values being inadequately indicated, repeatedly obtaining a new signal, averaging the new signal with the previous averaged signal, and determining if the newly averaged signal adequately indicates the discrete values.

76. The article of claim 52, wherein the means for averaging the multiple signals further comprise means for, in the retry mode, in response to the discrete values being inadequately indicated, repeatedly obtaining a new signal, averaging most recent signals to

generate a newly averaged signal, and determining if the newly averaged signal adequately indicates the discrete values.

77. The article of claim 76, wherein the means for averaging the most recent signals comprises means for averaging the three most recent signals.

78. The article of claim 45, wherein the means for averaging the multiple signals further comprise means for, in the retry mode, in response to the discrete values being inadequately indicated, repeatedly obtaining a new signal, averaging the new signal with the previous averaged signal, and determining if the newly averaged signal adequately indicates the discrete values.

Evidence Appendix

NONE.

Related Proceedings Appendix

NONE.